ON THE BIONOMICS OF THE SANDFLIES (PHLEBOTOMUS) OF TOKAR, ANGLO-EGYPTIAN SUDAN.

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The following observations were made during eighteen days spent at Tokar in October and November, 1912. Only a limited amount of time could be given to the work of searching for the breeding places of sandflies, but it is thought that possibly these very brief notes may be of some interest to those engaged in similar research elsewhere.

The town of Tokar is situated about eighteen miles from the port of Trinkitat on the Red Sea and some fifty-eight miles south-east of Suakin. It is the centre of a cotton-growing area comprising between 30,000 and 40,000 acres watered by the flood-river (or khor) Baraka. This khor comes down in flood during the months of July and August and spreads over the plain. As soon as the land is dry enough it is cleaned and almost the whole of it sown to cotton. A few heavy rainstorms usually occur during the months of October, November and December, and cotton picking extends from the latter month till May. The soil is alluvial, and on drying cracks vertically to a depth of several feet, and also horizontally, forming shale-like plates of varying thicknesses. There are scarcely any trees and only a moderate number of low bushes.

This cultivated area is notorious throughout the Sudan for the number and bloodthirstiness of its sandflies. The adults can be found in numbers at distances of at least two miles from any mud or brick wall or building. They are equally numerous on clean land growing cotton and on land on which cotton has failed and which therefore supports only a few grasses and other weeds. The general opinion of the officials who know the district well is that they are confined to the flooded area and that they are not met with in the surrounding desert. Natives who live in the town told me that there they were not troubled by them, but if one spent a night in the cultivations one would meet with plenty. The land on which the town is built is not flooded, being protected by a low embankment of soil.

The main difference between the flooded and unflooded land is the presence of deep cracks, referred to above, which appear in the former as soon as it begins to dry out. Newstead* states that all the sandfly larvae and pupae taken by Marett and himself in Malta were found living under similar conditions as regards (*a*) presence of organic matter, (*b*) presence of moisture, but not in excess, and (*c*) absence of light. The only situations where these three conditions could be found together at Tokar were in the soil itself, and on flooded land the cracks provided the sandfly with an easy means of access to such situations. If these cracks and the soil adjoining them were the breeding places of the Tokar sandflies, the reason why the adults were only found on flooded areas would be explained, and I could think of no other theory which would account for it. All the very limited amount of time which could be spared for this work was spent therefore in searching for larvae and pupae in the soil.

* Annals of Tropical Medicine and Parasitology, v, no. 2, August 1911, p. 141.

The spot chosen for the purpose was a plot of well-cleaned land under cotton, distant 1¾ miles from the nearest mud or brick building or wall. Here adult sandflies existed in myriads. Numbers could be found by turning over clods of earth, as many as fifteen—approximately—sometimes being seen under a single clod. Vertical cracks extended to a depth of from three to four feet, so holes were dug to this depth and the soil at the sides, especially that in the neighbourhood of cracks, carefully picked to pieces and searched. A single larva, which I believe to belong to a species of *Phlebotomus*, was obtained. This larva, which corresponds almost exactly with Newstead's figure and description of the second instar of the larva of *P. papatasii*, is described below. It was found at a depth of about four inches, in damp earth, in the vicinity of a crack, and when alive, closely resembled the soil in colour. Moreover when first exposed it did not move and so might easily have been overlooked. When placed on a flat surface it made no attempt to flick itself away but merely crawled slowly along by means of its prolegs. It was killed and preserved as the chances of my being able to rear the adult from it were, under the circumstances, infinitesimal.

Although I could find only this one specimen I believe that there were numbers in the soil. With a tropical sun shining on one's back, numbers of house-flies tickling one's face, and a gale of wind blowing dust into one's eyes and the particles of soil from under one's hand, it is not difficult to overlook such an inconspicuous object as a sandfly larva or pupa. Lumps of soil were taken to the house and examined there but these yielded nothing.

A species of wagtail (*Motacilla alba*) was frequently observed catching adult sandflies at dawn, before they had taken shelter for the day.

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Description of Phlebotomus larva.

Length: 3 mm. Colour: general appearance when alive, dark brown; after death, head dark brown, mandibles, labial plate and dorsal process on anal segment black, hairy spines yellowish-brown, thorax and abdomen yellowish-white.

The first joint of the antenna is small, the second and third are broad, flat and rounded in outline, the latter terminating in a short bristle. The thoracic segments have the rows of hairy spines continued on the ventral surfaces, forming complete rings. A similar ring is situated on the space between the head and the first thoracic segment, the ventral spines of this ring—four in number—being long and pointed instead of comparatively short and clubbed. The hairy spines on the thorax and abdomen are shorter and more noticeably clubbed near the head, and become longer and less clubbed towards the anal end. The transparent tips of these hairy spines are less swollen than are those of *P. papatasii*. On the basal half of the dorsum of the anal segment is situated a black process, roughly rectangular in outline with a finely serrated margin. From the top of this process arise two smaller processes, each bearing two of the four caudal bristles and also two hairy spines, similar to those on the abdominal segments. There is a dark area on the dorsum of the penultimate segment.

So far as I can judge from Newstead's figure and description, this larva resembles that of *P. papatasii* in its second instar in all other details,